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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/700,295	11/03/2003	Michael E. Badding	SP03-079A	6519

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CORNING INCORPORATED
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CORNING, NY 14831

EXAMINER	
WALKER, KEITH D	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/700,295	BADDING ET AL.
	Examiner	Art Unit
	Keith Walker	1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 August 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 29-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 29-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Claims 1-12 & 29-32 are pending examination.

Claim Rejections - 35 USC § 112

The rejection of Claims 1, 4-12 & 29-32 under 35 U.S.C. 112, first paragraph have been withdrawn in view of the arguments of 8/24/07. See claims interpretation section below.

Claim Interpretation

In light of the arguments of 8/24/07, the limitation "electrolyte sheet includes thicker and thinner areas and the thickness of the electrolyte sheet changes progressively close to the edges" is interpreted to mean the electrolyte thickness changes as the electrolyte surface is traversed closer to the edge (progressively closer to the edge).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 2, 4-12, 29, 30, 32 & 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) and evidenced by *Fuel Cell Systems*.

Regarding claims 1, 2, 4-6 & 9 McElroy discloses a flexible ceramic yttria stabilized zirconia electrolyte with at least one non-uniform surface, where the surface is textured with a plurality of protrusions having a height of 0.5 to 2.5 microns ([0187, 0189]). The components making up the electrolyte are mixed together forming a slurry and then applied to a Mylar film and spread using a doctor blade making a uniform electrolyte structure ([0207]). It is obvious to one skilled in the art the art that this process makes a homogeneous body and it is well known in the art that the electrolyte is non-porous (Evidenced by *Fuel Cell Systems*, Pg. 108, Sec. 3.6.2.3). The electrolyte has thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edge (Fig. 13).

When using the electrolyte with one non-uniform surface, the orientation of the non-uniform surface towards which electrode is not discussed. Since only two choices exist, pointing the textured side to the anode or the cathode is seen as a rearrangement of parts, it would have been obvious to one having ordinary skill in the art at the time the invention was made to change the orientation of the electrolyte sheet to optimize the performance of the fuel cell, since it has been held that rearranging parts of an invention involves only routine skill in the art (*MPEP 2144.04*). As pointed out in applicant's specification ([0104]), it is known to have a higher flow of air across the cathode, creating greater compressive force on the high-pressure side (airside) and a greater

tensile force on the fuel side. So it is inherent that the fuel cell, taught by McElroy, has a predominately compressive force on the airside and tensile force on the fuel side. The average electrolyte thickness is 10 – 250 microns thick ([0187]). The electrolyte sheet taught by McElroy is made from the same material and has the same thickness as disclosed in the specification. Therefore, it is inherent the electrolyte sheet is bendable to an effective radius of curvature of less than 20 cm and the ohmic resistance is less than 0.2 ohms/cm^2. Regarding the ohmic resistance, applicant has not disclosed under what conditions the ohmic resistance is taken. Furthermore, since the ohmic resistance is dependent on the thickness of the electrolyte sheet, it would be obvious to one skilled in the art at the time of the invention to make the electrolyte sheet thinner to reduce the resistance of the sheet.

Since the protrusions can have any shape, such as triangle, pyramidal or semi-spherical, these geometrical shapes provide an electrolyte sheet where at least 75% of the area of the electrolyte sheet has a thinner body than the rest of the electrolyte sheet.

2. Claims 1, 2, 4-12 & 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2002/0012825 (Sasahara) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent as to which electrode the electrolyte's textured surface faces.

Sasahara teaches an electrolyte with three-dimensional features on one face of the electrolyte (Abstract; Figs. 3 A, B; [0038, 0043]). The three-dimensional features (textured surface) have a depth range of 5 – 500 microns and face toward the cathode side (Figs. 13 A, B; [0019, 0062]). The textured surface provides for a high reaction surface area-to-volume ratio, thereby increasing the volumetric power density. The thinner sections of the electrolyte sheet are textured (Fig. 8, [0020, 0049]). Furthermore, the structural rigidity is improved allowing for a significant decrease in device size ([0014, 0018]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte of McElroy with the textured surface of Sasahara to improve the structural rigidity and the volumetric power density.

3. Claims 8, 9 & 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2001/0044043 (Badding) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent to the electrolyte being non-porous.

Badding teaches the electrolyte as a dense material ([0003]), while the electrodes are described as a porous material. By describing the electrode as being porous and the electrolyte as dense, one of ordinary skill in the art would infer this to be a substantially non-porous body. The dense (non-porous) electrolyte material prevents

reactant crossover and the electrolyte thickness enhances the thermal shock resistance and electrochemical performance (4:1-10).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of McElroy with the electrolyte thickness as taught by Bedding, since it would have enhanced the thermal shock resistance and electrochemical performance.

4. Claims 1, 2, 4-12, 29, 30, 32 & 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of JP Publication 05-258756 (Kato) and evidenced by *Fuel Cell Systems*.

The disclosure of McElroy and *Fuel Cell Systems* as discussed above are incorporated herein.

McElroy is silent as to which electrode the electrolyte's textured surface faces.

Kato teaches texturing the oxidant surface of a fuel cell electrolyte (Abstract, 0022, 0023, 0026]). The texturing allows the expansion of the reaction surfaces between the cathode and the electrolyte, thereby improving the electrochemical reaction of the fuel cell. While the electrolyte between the two references is different, the teaching of texturing the surface of an electrolyte to produce more reactive surface area between the electrode and electrolyte is transferable between the electrolyte types.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify textured electrolyte of McElroy with the

teachings of Kato, to arrange the textured surface toward the cathode and produce a larger reactive area for the oxygen reduction reaction.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5,521,020 (Dhar) in view of US Publication 2002/0012825 (Sasahara).

The teachings of Sasahara as discussed above are incorporated herein.

Dhar teaches a fuel cell with an electrolyte layer. While the electrolyte layer is not described as being a substantially homogeneously non-porous body, it is well known to use a non-porous electrolyte to prevent reactant gas crossover. The electrolyte is thicker in the middle and tapers off toward the edges (Fig. 1b; Abstract; 5:5-20). As pointed out in applicant's specification ([0104]), it is known to have a higher flow of air across the cathode, creating greater compressive force on the high-pressure side (airside) and a greater tensile force on the fuel side. So it is inherent that the fuel cell, taught by Dhar, has a predominately compressive force on the airside and tensile force on the fuel side.

Dhar is silent to one side having a textured surface wherein the thickest part is at least 0.5 microns greater than the thinnest part.

Sasahara teaches an electrolyte with three-dimensional features on one face of the electrolyte (Abstract; Figs. 3 A, B; [0038, 0039, 0043]). The three-dimensional features (textured surface) have a depth range of 5 – 500 microns and face toward the cathode side (Figs. 13 A, B; [0019, 0062]). The textured surface provides for a high reaction surface area-to-volume ratio, thereby increasing the volumetric power density.

The thinner sections of the electrolyte sheet are textured (Fig. 8, [0020, 0049]). Furthermore, the structural rigidity is improved allowing for a significant decrease in device size ([0014, 0018]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte of Dhar with the textured surface of Sasahara to improve the structural rigidity and the volumetric power density.

Response to Arguments

Applicant's arguments filed 8/24/07 have been fully considered but they are not persuasive.

Applicant argues McElroy doesn't teach an electrolyte sheet where the thickness changes as the surface is traversed from the middle to the edge. As shown in at least figure 13 of McElroy, the thickness changes multiple times as across the surface of the electrolyte sheet toward the edge.

Applicant alleges the electrolyte sheet taught by McElroy is not inherently flexible since the reference does not mention or imply the flexibility. Since the characteristic is inherent, it is unnecessary to state the characteristic it is inherent. As stated above in the rejection, since the electrolyte sheet of the prior art and the claimed invention are made of the same material, have the same thickness with the same variations in thickness, then the flexibility and the ohmic resistance are inherently the same. Applicant states that an electrolyte sheet 250 microns thick is not likely to be bendable to an effective radius of 20 cm and the ohmic resistance less than 0.2 ohms/cm2.

However, an electrolyte of this thickness does not have to meet those limitations since they are not the same as the claimed thickness. The electrolyte with a thickness of 10 – 100 microns needs to meet the flexibility and ohmic resistance limitations and since these limitations are inherent, the electrolyte sheet taught by McElroy with these thicknesses and variations in thicknesses anticipates the limitations. As pointed to by applicant, paragraphs [0044 & 0045] of the instant specification state the ohmic resistance is dependent on the average thickness of the electrolyte sheet. McElroy teaches an electrolyte sheet of the same material and average thickness as the claimed invention and therefore the ohmic resistance is inherently the same.

Applicant argues that at least 50% or 75% of the area of the electrolyte sheet situated under the cathode has a thinner body than the rest of the electrolyte sheet. Using figure 13 of McElroy as an example, the sinusoidal pattern has multiple peaks and valleys. Any part of the sinusoidal patterned electrolyte that is not the peak is an area that is thinner and as such all those thinner parts together make up more than 75% of the area under the cathode or anode.

Applicant argues Sasahara doesn't teach an electrolyte with a textured surface but only a corrugated electrolyte of the same thickness with shallow texturing and cites figure 8 of Sasahara as evidence. However, as stated above, the rejection is also based on figures 3A, 3B, 13A and paragraphs [0038, 0043, 0019, 0062] where the electrolyte sheet with a smooth surface on one side and a textured surface on the other side are taught. Furthermore, the textured surface of figure 8 does produce a surface with thicker and thinner areas.

The fact that US Publication 2001/0044043 and the claimed invention were at the time of the invention owned or subject of obligation of assignment to Corning, Inc. is inconsequential in terms of rejections since the prior art is available as a 102 (b) reference.

Applicant argues the Kato reference is directed to a different technology and therefore not combinable with the McElroy reference. While the electrolytes are different and taking the polymer electrolyte membrane material of Kato and putting it in the solid oxide fuel cell of McElroy would incinerate the membrane, the teaching by Kato to increase the reactant surface area between the cathode and electrolyte is transferable between fuel cells. Furthermore, the prior art of US Publication 2002/0012825 (Sasahara) teaches electrolytic patterns for both polymer electrolyte material and solid oxide material ([0038, 0050]). Therefore one skilled in the art would look to other fuel cell types for various teachings to improve the performance of a fuel cell. Applicant also alleges no motivation to combine is provided. As stated in the rejection, "the texturing allows the expansion of the reaction surfaces between the cathode and the electrolyte, thereby improving the electrochemical reaction of the fuel cell." (Kato [0023, 0026]).

Applicant argues paragraph [0104] of the instant specification that discussed operating a fuel cell with more airflow across the cathode is only for the embodiments of the invention and therefore not admitted prior art. First, the claim is drawn to a product and not a method of operating. So the operational parameters do not carry patentable weight with the claimed product. Furthermore, the combined teachings of the prior art

meet the claimed product limitations and therefore obviate the claim. Second, while the Examiner disagrees with the position that the portion of paragraph [0104] that discusses typically operating the fuel cell with a higher air flow, operating the fuel cell with a higher flow of air compared to the fuel is still well known in the art (US Publication 2004/0151975, paragraph [0062]; US Patent 5,268,241, (6:40-45)).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keith Walker whose telephone number is 571-272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

K. Walker

MARK RUTHKOSKY
PRIMARY EXAMINER

11.8.2007